What is claimed is:

1. An optical information recording and reproducing apparatus for recording information bits into an information recording medium having a recording member into which information bits are recorded in a three-dimensional arrangement by changing an optical constant of the recording member of the recording medium, the apparatus comprising:

a light source that emits a light beam;

an objective lens that converges the light beam emitted from the light source to an information recording medium; and

a light detector that detects the light beam from the information recording medium,

wherein a thickness of the recording member is larger than a wavelength of the light beam, and

the information bits are sequentially recorded into the recording member in a three-dimensional arrangement such that a converging light beam from the objective lens does not pass through information bits that have already been recorded.

2. The apparatus according to claim 1, wherein the information bits are sequentially recorded from the farthest points from the objective lens in the recording

member.

3. The apparatus according to claim 1, wherein the objective lens comprises a lens of which numerical aperture is more than or equal to 0.7, and pinholes are disposed in an optical path including the objective lens and the light detector, thereby the light beam from the information recording medium is detected by the light detector after passing through the pinholes.

4. The apparatus according to claim 1 further comprising a focus/track error signal detecting optical element which is an optical splitting element and disposed in an optical path including the objective lens and the light detector, and a pinhole array having a plurality of pin holes and disposed in the optical path,

wherein the light beam from the information recording medium is split into a plurality of light beams by means of the focus/track error signal detecting optical element, and the plurality of light beams are detected by the light detector after passing through corresponding pinholes of the pinhole array.

5. The apparatus according to claim 1, further comprising a focus/track error signal detecting optical element disposed in an optical path including the objective lens and the light detector,

wherein the light beam from the information

recording medium is split into a plurality of light beams by means of the focus/track error signal detecting optical element, and each split light beam is detected by the light detector having an area smaller than that of the split light beam.

6. The apparatus according to claim 1 further comprising a focus/track error signal detecting optical element disposed in an optical path including the objective lens and the light detector, and a pinhole array having a plural pinholes and disposed on the optical path,

wherein the light beam from the information recording medium is split into a plurality of light beams by means of the focus/track error signal detecting optical element, and the light beams corresponding to track error signals are detected by the light detector after passing through pinholes of the pinhole array.

7. The apparatus according to claim 1, wherein the wavelength λ of the light beam emitted from the light source substantially is in a range satisfying $0.35\mu m \leq \lambda \leq 0.45\mu m$, and the optical system including the objective lens is configured to be achromatic.

8. The apparatus according to claim 1, further comprising a spherical aberration correcting element disposed in an optical path including the light source and the objective lens, wherein the spherical aberration

correcting element controls an amount of spherical aberration in accordance with a recording depth of the information bits to be recorded into the recording member.

9. The apparatus according to claim 1, wherein the optical constant is a refractive index.

10. The apparatus according to claim 9, wherein amount of the change in refractive index is more than or equal to 0.005.

11. The apparatus according to claim 1, wherein the information recording medium comprises only a single recording member.

12. The apparatus according to claim 1, wherein the information recording medium comprising a recording member and a substrate.

13. The apparatus according to claim 1, wherein the information recording medium is configured by a recording member sandwiched between a substrate and a protecting member.

14. The apparatus according to claim 1, wherein the light detector comprises an avalanche photodiode.

15. The apparatus according to claim 1, further comprising a condenser lens disposed on one side of the information recording medium opposite to the objective lens, the condenser lens converging the light beam from the information recording medium to the light detector to

detect the light beam.

16. The apparatus according to claim 1, wherein a focus position of the objective lens is controlled with reference to an interface of the recording member of the recording medium.

17. An optical information recording and reproducing apparatus for recording information bits into an information recording medium having a recording member into which information bits are recorded in a three-dimensional arrangement by changing a refractive index of the recording member of the recording medium, the apparatus comprising:

a light source that emits a light beam;

an objective lens that converges the light beam emitted from the light source to an information recording medium; and

a light detector that detects a light beam from the information recording medium,

wherein a thickness of the recording member is larger than a wavelength of the light beam,

wherein amount of the change in refractive index is less than or equal to 0.02, and

wherein the information bits are recorded sequentially into the recording member in a three-dimensional arrangement such that the number of rows of information bits which have been already recorded in the

direction of optical axis is not more than 4.

18. The apparatus according to claim 17, wherein the objective lens comprises a lens of which numerical aperture is more than or equal to 0.7, and pinholes are disposed in an optical path including the objective lens and the light detector, thereby the light beam from the information recording medium is detected by the light detector after passing through the pinholes.

19. The apparatus according to claim 17 further comprising a focus/track error signal detecting optical element which is an optical splitting element and disposed in an optical path including the objective lens and the light detector, and a pinhole array having a plurality of pin holes and disposed in the optical path,

wherein the light beam from the information recording medium is split into a plurality of light beams by means of the focus/track error signal detecting optical element, and the plurality of light beams are detected by the light detector after passing through corresponding pinholes of the pinhole array.

20. The apparatus according to claim 17, further comprising a focus/track error signal detecting optical element disposed in an optical path including the objective lens and the light detector,

wherein the light beam from the information

recording medium is split into a plurality of light beams by means of the focus/track error signal detecting optical element, and each split light beam is detected by the light detector having an area smaller than that of the split light beam.

21. The apparatus according to claim 17 further comprising a focus/track error signal detecting optical element disposed in an optical path including the objective lens and the light detector, and a pinhole array having a plural pinholes and disposed on the optical path,

wherein the light beam from the information recording medium is split into a plurality of light beams by means of the focus/track error signal detecting optical element, and the light beams corresponding to track error signals are detected by the light detector after passing through pinholes of the pinhole array.

22. The apparatus according to claim 17, wherein the wavelength λ of the light beam emitted from the light source substantially is in a range satisfying $0.35\mu m \leq \lambda \leq 0.45\mu m$, and the optical system including the objective lens is configured to be achromatic.

23. The apparatus according to claim 17, further comprising a spherical aberration correcting element disposed in an optical path including the light source and the objective lens, wherein the spherical aberration

correcting element controls an amount of spherical aberration in accordance with a recording depth of the information bits to be recorded into the recording member.

24. The apparatus according to claim 17, wherein the information recording medium comprises only a single recording member.

25. The apparatus according to claim 17, wherein the information recording medium comprising a recording member and a substrate.

26. The apparatus according to claim 17, wherein the information recording medium is configured by a recording member sandwiched between a substrate and a protecting member.

27. The apparatus according to claim 17, wherein the light detector comprises an avalanche photodiode.

28. The apparatus according to claim 17, further comprising a condenser lens disposed on one side of the information recording medium opposite to the objective lens, the condenser lens converging the light beam from the information recording medium to the light detector to detect the light beam.

29. The apparatus according to claim 17, wherein a focus position of the objective lens is controlled with reference to an interface of the recording member of the recording medium.